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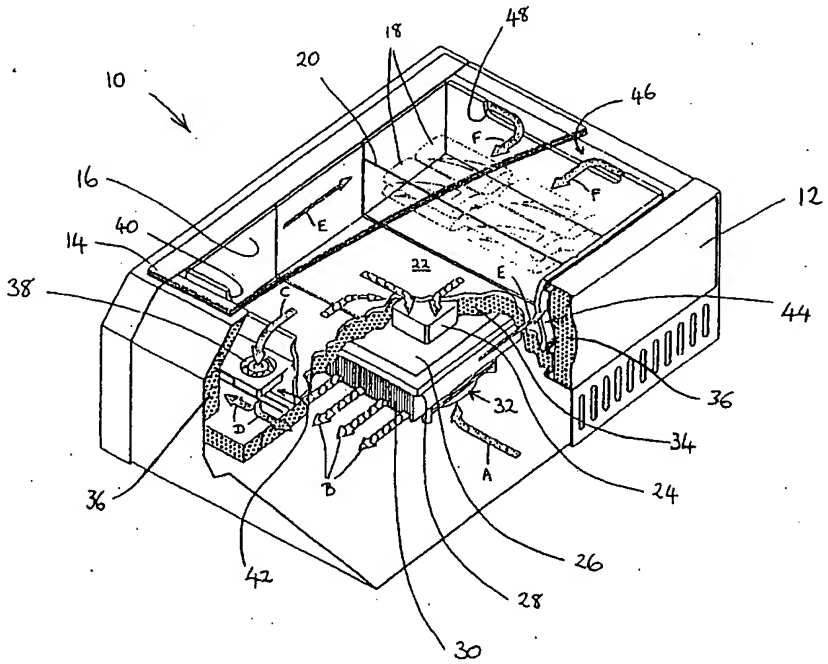
(54) Title: A COOLING DEVICE



(57) Abstract: A cooling device (10) consisting of an outer shell (12) and a lid (14), an inner shell (16) formed of a conductive material for receiving goods to be cooled, a heat pump means (26) connected to the conductive shell for drawing heat from the shell and means (38) for circulating air within the shell.

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TITLE: A COOLING DEVICE

FIELD OF THE INVENTION

The present invention relates to a display for consumables, such as food and/or beverages, and in particular a display having a cooling system to allow cooling of the food and/or beverages for sale in a cooled state.

With regard to the sale of both food and beverages, there exists a conflict between the desire to cool the food and/or beverage for consumption at a lower than ambient temperature, and the desire to display the goods so that a likely consumer has ready

access to the cooled goods for purchase.

BACKGROUND OF THE INVENTION

Existing "point of sale" refrigerated displays have often included compressed fluid based refrigerators which include a compressor which compresses the refrigerant fluid, and an expansion zone where the fluid expands to provide the cooling effect. In addition to the uncertain environmental effects of such refrigerant fluids (including environmental damaged caused by fluids in use until recently), these devices are generally bulky, and often noisy. They include, by their nature, moving parts, and complex plumbing systems to allow containment of the fluid, which is often volatile.

As such, positioning of point of sale refrigerated display units in areas of retail outlets nearby to cash registers and in other positions convenient for encouraging impulse purchases has been problematic. Noise and bulk associated with such refrigeration devices has been prohibitive.

Heat pump devices have been proposed for refrigeration applications, however, such devices were invariably found to be unviable. Low power outputs (in terms of heat transfer) and inefficient configurations have resulted in such heat pump devices being rejected as alternatives to compressed fluid systems in food display appliances.

It is an object of the present invention to provide an alternative cooling device for consumables which avoids problems associated with compressed fluid refrigerators, and provides a cost effective means to cool the consumables, such as food and/or beverages, for the purposes of display of cooled goods.

SUMMARY OF THE INVENTION

In accordance with a first embodiment of the invention, there is provided a cooling device including:-

a conductive shell for receiving goods to be cooled;

a heat pump means connected to said conductive shell for drawing heat from the shell;

an outer shell encasing the conductive shell and providing access to goods received therein; and

means for circulating air within the outer shell.

PREFERRED ASPECTS OF THE INVENTION

Preferably, the conductive shell has inner and outer surfaces, and the air circulated within the outer shell passes over both surfaces of the conductive shell.

Preferably, the configuration of the cooling device is such that goods received in the conductive shell are cooled both by conduction of the conductive shell, and convection associated with the circulating air within the outer shell.

Preferably, the heat pump is a Peltier device. Preferably, the "cold side" of the Peltier device comprises the entire conductive shell.

Preferably, the conductive shell is composed of solid aluminium. Preferably, the mass of the conductive shell is high in proportion to the power of the heat pump. Preferably, the conductive shell may be powder coated. Preferably the conductive shell may be plastic dipped.

Preferably, the conductive shell is a solid continuous shell which provides the function of an evaporator in a traditional refrigeration device.

Preferably, the cooling device includes access means to enable removal of goods received therein. Preferably such access means includes a convenient opening in the outer shell. Preferably air circulating within the outer shell acts as an air curtain to contain cool air within the cooling device.

Preferably, the device may be provided with a lid, closeable to enclose the cooled zone of the cooling device, and openable to allow access to the contents therein.

In accordance with a second aspect of the present invention, there is provided a cooling device, including:-

an enclosure substantially comprised of a conductive shell for receiving goods to be cooled in a cooled zone; and

heat pump means including hot side and cold side heat distributors;

wherein the hot side heat distributor is located outside the cooled zone, and the cold side heat distributor consists substantially of the said conductive shell.

BRIEF DESCRIPTION OF THE VIEWS OF THE DRAWINGS

A preferred embodiment of the invention will now be described with reference to the attached drawings, in which:-

Figure 1 is a partially cut-away perspective view of a cooling device in accordance with a first embodiment of the invention;

Figure 2 is a sectional perspective view of a cooling device in accordance with a second embodiment of the present invention; and

Figure 3 is a sectional side view of the cooling device of Figure 2.

DETAILED DESCRIPTION WITH RESPECT TO THE DRAWINGS

Referring firstly to Figure 1, there is shown a cooling device 10, having an outer shell 12 and a lid 14. An inner shell 16 forms a receptacle for food items 18, and is enclosed by the lid 14. One or more barriers 20 may be provided to divide the cooling volume contained by the inner shell 16 and the lid 14. A gap is provided between the barrier 20

and the lid 14 to allow air flow between the sections of the enclosed space.

The inner shell 16 is formed of solid conductive material, in this embodiment of aluminium, and is directly connected to a further solid block of conductive material (also aluminium in this case), referred to herein as the transfer block 24, on the opposite surface of the inner shell from the surface 22 which forms the receptacle volume with the lid 14.

The transfer block 24 is directly connected to a Peltier device 26, which acts to transfer (or "pump") heat from the transfer block 24 to a further conductive block, referred herein as a dissipation block 28, which includes an array of aluminium fins 30 through which heat transferred into the dissipation block 28 can be efficiently dissipated. A fan 32 draws external air at ambient temperatures as indicated by air flow indicator arrow A. Air drawn through the fan 32 then passes through the aluminium fins 30 allowing heat to be transferred from the aluminium fins 30 to the air and dissipated as indicated by air flow indicator arrows B.

The dissipation block 28, aluminium fins 30 and fan 32 are on the "hot side" of the Peltier device 26. The hot side of the device is separated from the "cold side" components of the inner shell 16 by insulating foam 34. Other cold side regions of the device are insulated from the external shell 12 (and therefore external temperatures) by insulating foam 36.

On the cold side of the device, a substantial improvement in efficiency is gained by circulating air within the insulated region of the cold side. A further fan 38 is provided within the cold side enclosure (or the cooled region of the cooling device). The fan 38 is positioned at a lower end of the inner shell 16. The fan 38 draws air from the receptacle volume enclosed by the inner shell 16 and the lid 14 through a recess 40 formed in the inner shell 16, thus forming a gap between the inner shell 16 and the lid 14.

Air drawn through the recess 40 and through the fan 38 is then pumped through base conduit 42, formed between the insulating foam 36 and inner shell 16, as shown by air flow indicator arrows D. Air then flows to side conduits 44 (right hand conduit only

shown) formed between the insulating foam 36 and the inner shell 16, as shown by air flow indicator arrows E. Air is thus delivered to an upper conduit 46 and through a gap formed between the lid 14 and the inner shell 16 formed by recess 48 formed in the inner shell 16, as shown by air flow indicator arrows F. In this way, air is circulated around the cooled region of the cooling device 10.

This circulation contributes to the efficiency of the cooling device 10 by allowing the cooling effect of the cold side "heat sink" formed by the inner shell 16 to have maximum effect by passing the air in the cooled region over both surfaces thereof. The solid aluminium construction of the "heat sink" inner shell 16 also allows for high conductivity, and thus greater efficiency of the Peltier device 26. The fan 38 is not required to be particularly powerful, and should emit as little heat as possible so as to limit any warming effect caused by the existence of the additional fan 38.

In relation to the heat transfer from the surface 22 to the transfer block 24, there has arisen the potential for "choking" of the heat flow, where the area of contact between the surface 22 and the transfer block 24 is insufficient to transfer heat to the full capabilities of the Peltier device 26. In this case the applicant has proposed the addition of a further transfer plate (not shown) positioned between the surface 22 and the transfer block 24.

The transfer plate has a surface area less than that of the surface 22, and greater than that of the transfer block 24. This graduation between the large surface area of the surface 22 and the relatively small surface area of the transfer block 24 enhances heat flow and reduces the potential for "choking" of the heat flow at the junction between the surface 22 and the transfer block 24.

Referring to Figures 2 and 3, these illustrate a further embodiment of the invention which generally incorporates similar components, which are numbered accordingly.

While generally operating in accordance with the same principles, this further embodiment varies somewhat in the actual manner of carrying out the invention. In this embodiment, a lid 14 is provided as per the first embodiment, however, this lid 14 is positioned at the top of the more upright structure of this device, and is generally used

for depositing items 18 to be cooled in the cooler 10. Such items are intended to be removed by customers through an opening 60 near the base of the front transparent wall 62 of the device. This allows customer to more easily remove the goods 18 being cooled.

In this embodiment, the air flow within the cooled region of the device 10 is somewhat altered. Fan 38 still causes the circulation of the cooled air within the cooled region, however the path of the air is different. Air is drawn from the base region 64 of the device 10 and delivered from the lower side of a dividing plate 66 to the upper side thereof to the upper base region 68. The air then flows from the upper base region 68 through upward passages (not shown) formed between the side walls 70 of the inner shell 16 and insulating foam 36 of the sides of the device 10.

The upper edges 72 of the side walls 70 and the lid 14 form a gap 74 through which air flows into the receptacle chamber formed by the inner shell 16, the front wall 62 and the lid 14. The air then flows down through the receptacle chamber and is drawn through apertures 76 in the inner shell 16. Apertures 76 are connected to the base region 64, and thus air flow returns to the fan 38 for continued circulation.

In one alternative embodiment (not shown), the cooler is provided without a lid. Goods within the cooling device 10 is provided without a lid. Goods within the cooling device 10 are accessed through an opening in the cooling device 10 which does not have a closure. This embodiment would be most suitably used in relatively stable airconditioned environments. Although it will clearly not be possible to prevent cool air escaping from the cooling device 10 in this situation, the effect of such losses can be minimised by the use of an air curtain effect. The air curtain would be provided by the air flow generated by the fan 38. As air circulated by the fan 38 passes over the goods and is re-circulated within the cold side enclosure, the effect is that of an air curtain minimising escape of cooled air from the cooling device 10.

In a further embodiment (not shown), the lid 14 may be provided in the rear of the cooling device 10, so that access to the cooling device 10 is limited to, for example, a person behind a counter in a store where the cooling device may be situated. This provides the advantage that the shop attendant has control over access to the cooling

device 10, and the potential for theft is minimised.

The embodiment of Figures 2 and 3 also includes a thermostat 78 in the base region 64. This is a simple device which is simply designed to ensure that the goods 18 in the cooling device 10 are not cooled to too low a temperature. It essentially switches off the Peltier device when the temperature in the base region 64 reaches a predetermined low temperature. As it is considered important in some applications that the temperature of the products not fall below zero degrees Celsius, the cut-off temperature for the thermostat 78 may be set at around three to four degrees Celsius.

In the present embodiments proposed, it is intended that the cooling device 10 will cool the air within the cooled region of the device to approximately 14 degrees Celsius below ambient room temperature. As such, the device will generally only be consuming electricity continuously where ambient air temperature is above seventeen to eighteen degrees Celsius. Below these temperatures, the device will be operating only part of the time. This may result in further cost savings.

In the present embodiments proposed, the mass of the solid aluminium inner shell is high when compared with the power of the Peltier device. This high mass enables efficiencies in the operation of the device. The solid mass of aluminium of the inner shell actually "stores" coolness by constantly having heat drawn from it by the heat pump, and the mass of aluminium provides a significant inertia preventing or reducing rising temperature during ambient temperature peaks.

It is to be understood that various modifications of and/or additions to the invention can be made without departing from the basic nature of the invention. These modifications and/or additions are therefore to be considered to fall within the scope of the invention.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A cooling device, including:-

a conductive shell for receiving goods to be cooled;

a heat pump means connected to said conductive shell for drawing heat from the shell;

an outer shell encasing the conductive shell and providing access to good received therein; and

means for circulating air within the outer shell.

2. A cooling device in accordance with Claim 1, wherein the conductive shell has inner and outer surfaces, and air circulated within the outer shell passes over both surfaces of the conductive shell.

3. A cooling device in accordance with either one of Claims 1 or 2, wherein the configuration of the cooling device is such that goods received in the conductive shell are cooled both by conduction of the conductive shell, and convectio associated with the circulating air within the outer shell.

4. A cooling device in accordance with any one of the preceding claims in which the heat pump is a Peltier device.

5. A cooling device in accordance with Claim 4, in which the cold side of the Peltier device comprises the entire conductive shell.

6. A cooling device in accordance with any one of the preceding claims, in which the conductive shell is composed of solid aluminium.

7. A cooling device in accordance with any one of the preceding claims, in which

the mass of the conductive shell is high in proportion to the power of the heat pump.

8. A cooling device in accordance with any one of the preceding claims, in which the conductive shell is powder coated.

9. A cooling device in accordance with any one of Claims 1 to 7, in which the conductive shell is plastic dipped.

10. A cooling device in accordance with any one of the preceding claims, in which the conductive shell is a solid continuous shell which provides the function of an evaporator in a traditional refrigeration device.

11. A cooling device in accordance with any one of the preceding claims, in which access to goods received within the outer shell is provided by an opening in the outer shell such that potential purchasers of goods within the cooling device are able to access the goods.

12. A cooling device in accordance with Claim 11, in which air circulating within the outer shell acts as an air curtain to minimise the loss of cooled air through the opening in the outer shell.

13. A cooling device in accordance with any one of Claims 1 to 11, in which a lid is provided to substantially enclose the cooling device for normal operation, and which is openable to allow access to the goods within the outer shell.

14. A cooling device, including:-

an enclosure substantially comprised of a conductive shell for receiving goods to be cooled in a cooled zone; and

a heat pump means including hot side and cold side heat distributors;

wherein the hot side heat distributor is located outside the cooled zone, and the cold side heat distributor consists substantially of the said conductive shell.

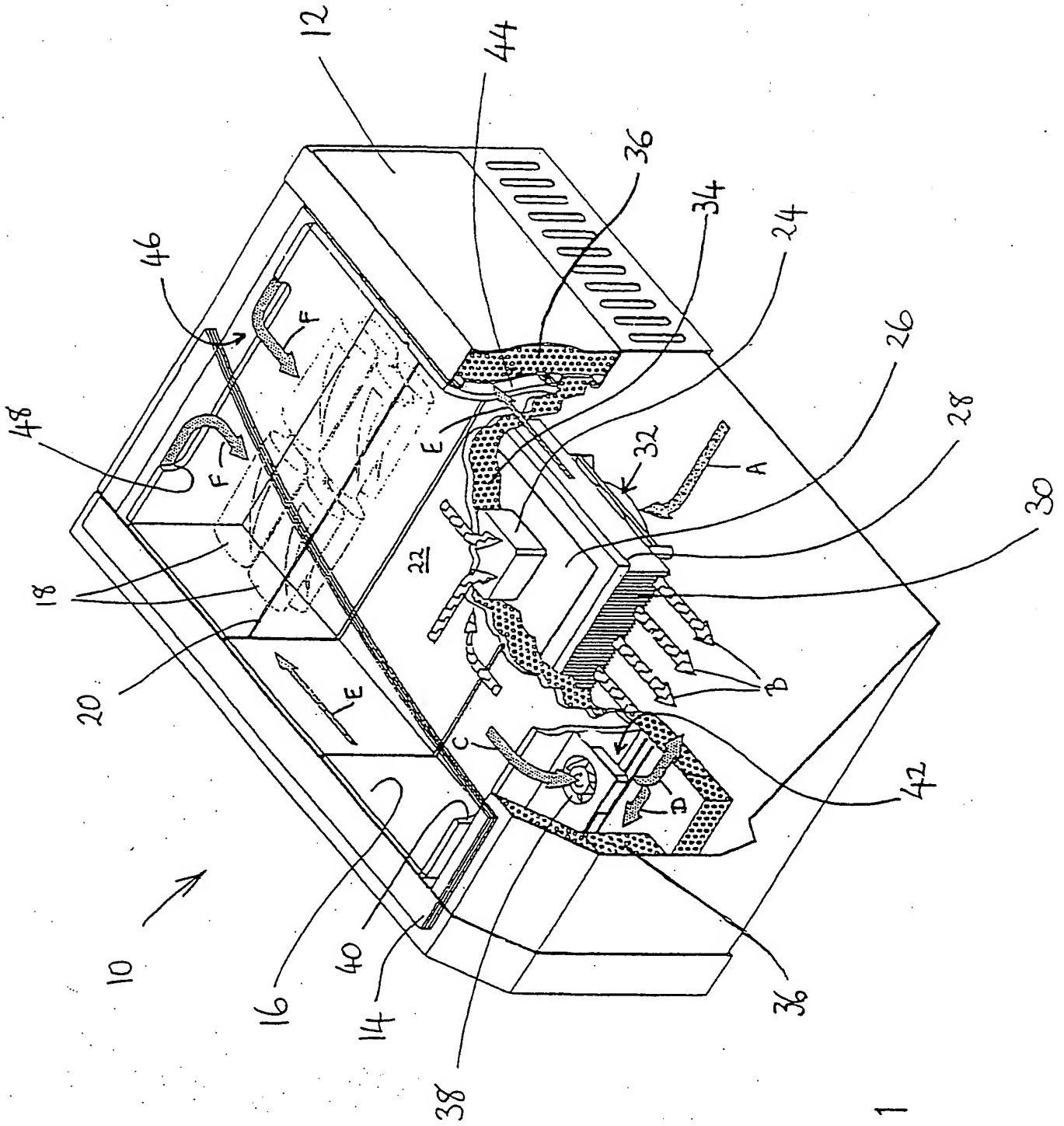
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FIG 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU01/01378

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: A47F 3/04 F25D 11/00 F25B 21/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC A47F 3/04 F25D 11/00 F25B 21/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI : IPC MARKS and HEAT PUMP, PELTIER

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98/30134 A (HANDEL) 16 July 1998 Entire document	1 - 14
X	US 3 733 836 A (CORINI) 22 May 1973 Entire document	1 - 14
X	US 5 718 124 A (SENECAL) 17 February 1998 Entire document	1 - 14

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 February 2002	18 FEB 2002
Name and mailing address of the ISA/AU	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU01/01378

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 941 077 A (SAFYAN) 24 August 1999 Entire document	14
X	US 5 771 788 A (LEE et al.) 30 June 1998 Entire document	14
X	EP 0 843 137 A (THERMOVONICS CO LTD) 20 May 1998 Entire document	14

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU01/01378

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
WO	9830134	DE	19700621	EP	1014836		
US	3733836	NONE					
US	5718124	US	5423194				
US	5941077	NONE					
US	5771788	CN	1172934	JP	10089828		
EP	843137	AU	45263/97	CN	1182864	JP	10148442
		US	5927078				

END OF ANNEX